

What role should governments play in broadband development?

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Why broadband?

Broadband is a key driver of economic growth and the competitiveness of nations². Recent World Bank research, presented in the *Information and Communication for Development 2009* report, suggests that the contribution of broadband to economic growth is indeed substantial, and may be more profound than comparable narrowband or voice-based ICTs, providing a boost of 1.38 percentage points on GDP growth in developing countries for every ten percentage points increase in broadband penetration (see Figure 1)³. Broadband is a General Purpose Technology (GPT)⁴ which is having a major impact on the way in which we live and work. Companies are using broadband to improve productivity through remote monitoring, logistics management and online procurement. They are also using broadband to provide services such as media content, online shopping and electronic banking services.

Broadband is also increasingly the primary mechanism for accessing information. Information is a public good which is essential for all forms of economic activity and good governance. Broadband provides access to new technologies, allows companies to explore new business opportunities, access customers and obtain information about market prices. Better access to information makes markets work more efficiently⁵ and raises producer incomes⁶. Ready access to information about the performance of government and politicians helps

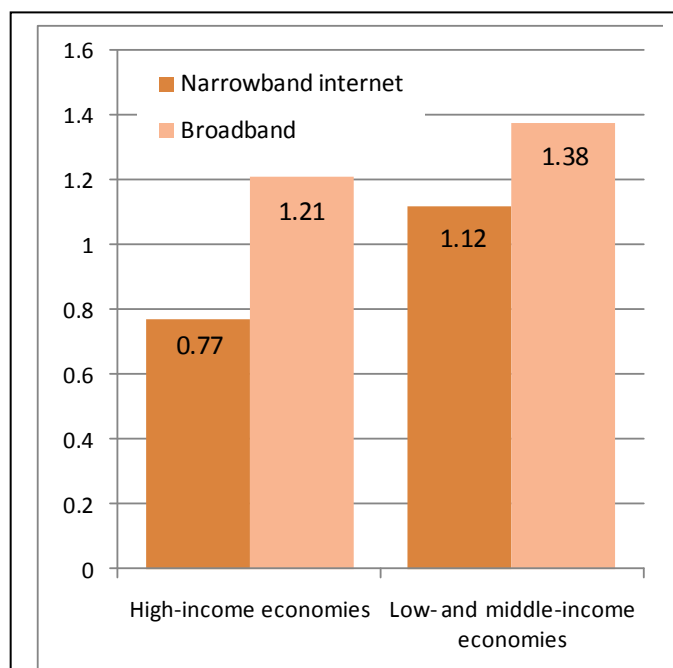


Figure 1: Impact of a ten per cent increase in penetration of selected ICTs on GDP per capita

Source: Adapted from World Bank (2009) “*Information and Communication for Development: Extending Reach and Increasing Impact*”.

Note: Based on an analysis of 120 economies, 1980-2006.

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² See, for example, OECD (2008) [Broadband and the Economy](#), Ministerial background report prepared for the OECD Ministerial Meeting on the Future of the Internet Economy, Seoul, 17-18 June 2009

³ See World Bank (2009) [Information and Communication for Development; Extending reach and increasing impact](#), especially chapter three.

⁴ See, for example, OECD (2007) [Broadband and the Economy](#)

⁵ See, for example, Does Digital Divide or Provide? The Impact of Cell Phones on Grain Markets in Niger Jenny C. Aker; University of California, Berkeley 2008

improve government accountability⁷ and improves quality of service provision⁸. By reducing the cost of accessing information about what governments are doing, broadband is becoming a key facilitator of good governance. Finally, broadband networks are increasingly being used to deliver public services: financial services, health-care, electronic voting, electronic land-registration are all examples of services that were previously delivered manually but are now being automated and delivered over broadband networks, often substituting online interaction for travel or the physical displacement of goods.

Despite the rapid growth in broadband networks that has already taken place, broadband is still in the early stages of deployment. The future will see wider deployment, increased capacity and a shift towards a wireless platform which will enable mobility. Broadband in developing countries is likely to follow a similar path but with a greater emphasis on wireless networks. In this context and given the significant economic and social benefits, expanding affordable access to broadband is becoming a high priority for governments of developed and developing countries alike. How is this best achieved? This note discusses the principles that should underlie government efforts to increase broadband access.

Broadband as an “ecosystem”

Broadband is typically defined as a “high-speed communications network” that connects end users at data transfer speeds that are greater than some minimum (e.g. 256 kbit/s). While this is a popular definition, it is incomplete. Connectivity is the critical component, but broadband is more than just a network.

Rather, broadband can be considered as an “ecosystem” that comprises different elements that use high-speed connectivity to interact in different ways (see Figure 2). By contrast with relatively passive dial-up Internet users, *broadband users* have the ability to create and share multimedia content in a variety of formats. This interactivity is an important factor that differentiates the broadband ecosystem from other high-bandwidth, but essentially passive networks, such as multi-channel TV. It also creates many new opportunities for value creation and innovation.

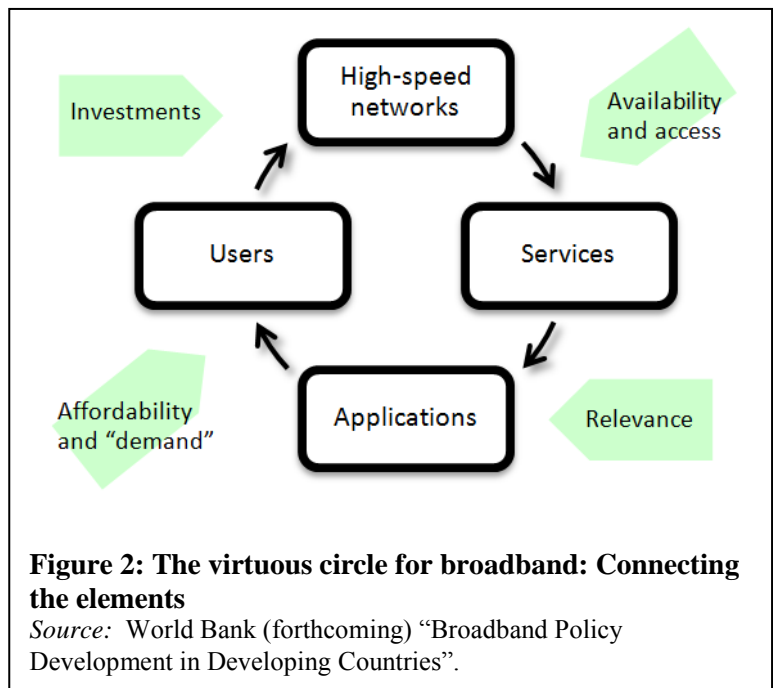


Figure 2: The virtuous circle for broadband: Connecting the elements

Source: World Bank (forthcoming) “Broadband Policy Development in Developing Countries”.

The growth of so-called *Web 2.0* services and applications that are dynamic and collaborative in nature depends on the ability of users to interact with each other, but also has implications for network development. For instance, older networks could offer uploads at lower speeds than downloads,

⁶ See, for example, Jensen, Robert. 2007 “The Digital Divide: Information (Technology), Market Performance and Welfare in the South Indian Fisheries Sector”. *The Quarterly Journal of Economics*; Vol. CXXII August 2007 Issue 3

⁷ See, for example, *The Political Economy of Government Responsiveness: Theory and Evidence From India** Timothy Besley and Robin Burgess, *Quarterly Journal of Economics*, 2002

⁸ See, for example, *The Power of Information: Evidence from a Newspaper Campaign to Reduce Capture*; Ritva Reinikka and Jakob Svensson World Bank, December, 2003

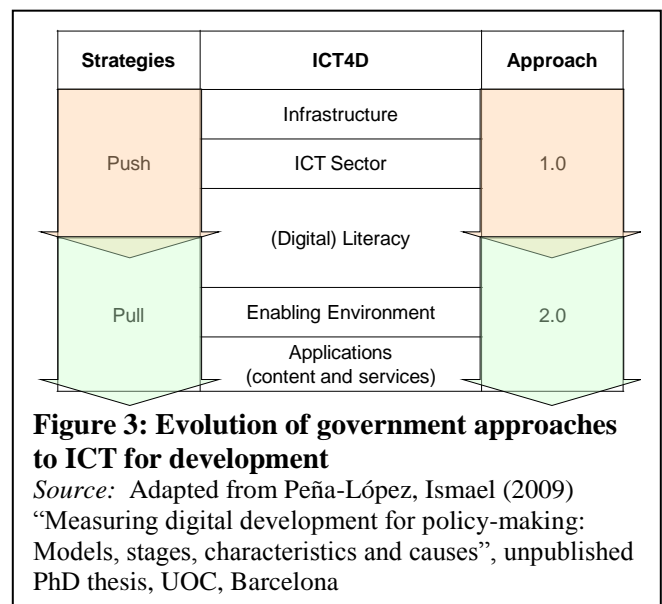
because this reflected typical user applications, such as email or web-browsing. But users of today’s two-way multimedia services will demand high-speeds in both direction. Worries about a deluge of bandwidth-hungry services overwhelming the Internet abound, but these dire predictions have only come true in isolated incidents and the global Internet seems remarkably robust in terms of scaling to a larger number of users, more demanding applications and higher speeds.

Hence, the network is part of an ecosystem that is evolving and includes users and applications that are more demanding. Simultaneously, users creating and sharing more content and applications that require more bandwidth should drive the supply of broadband. This virtuous cycle forms the basis of what we refer to as the broadband “ecosystem.” In this note, we define the *broadband ecosystem* as a multi-layered system of interconnected high-capacity communications networks, bandwidth-intensive services and applications, and users.

The role of government

Defining broadband as an “ecosystem” rather than simply as a network helps in positioning the likely role(s) that governments will need to play in using broadband as a tool in ICT for development (ICT4D). Traditionally, governments have played a “push” role in ensuring the right environment for the provision of ICT infrastructure and the development of the domestic ICT sector. This might be characterized as *Policy 1.0* (see Figure 3).

Increasingly, governments will need to move towards “pull” strategies aimed at promoting digital literacy, establishing an enabling environment, including an appropriate legal framework, and fostering the development of applications, including local content. This might be characterized as *Policy 2.0* and corresponds with popular concepts such as *Web 2.0* or *Mobile 2.0*.



Governments have taken quite different views on whether or not to establish a national strategy on broadband but, as a generalization, countries with coherent national strategies have tended to be more successful in fostering broadband diffusion. Most of the OECD countries that lead broadband penetration, including Denmark, the Netherlands, Norway, Korea, Sweden and Finland, have coherent broadband strategies. Even those pro-market economies that initially resisted defining a central government role have now crossed the fence. For instance, the UK government, in 2009, issued its “*Digital Britain*” report⁹ which includes, *inter alia*, a radical proposal to charge a levy of £6 (around US\$10) per year on fixed-line telephone subscriptions to create a fund for high-speed broadband services across the country. Similarly in the United States, after ten years of debate during which time it has fallen from second to fifteenth in the OECD broadband rankings¹⁰, the new government has belatedly announced the development of a National Broadband Plan, and has kicked off the discussion with a series of discussions hosted by the regulator, the Federal Communications Commission (FCC).¹¹

⁹ See: http://www.culture.gov.uk/what_we_do/broadcasting/5631.aspx/.

¹⁰ See Kelly, Tim (2009) “International Broadband Benchmarks” and other papers presented at the FCC workshop on “International lessons for broadband policy”, 18 August 2009, available at: http://www.broadband.gov/ws_int_lessons.html.

¹¹ See www.broadband.gov.

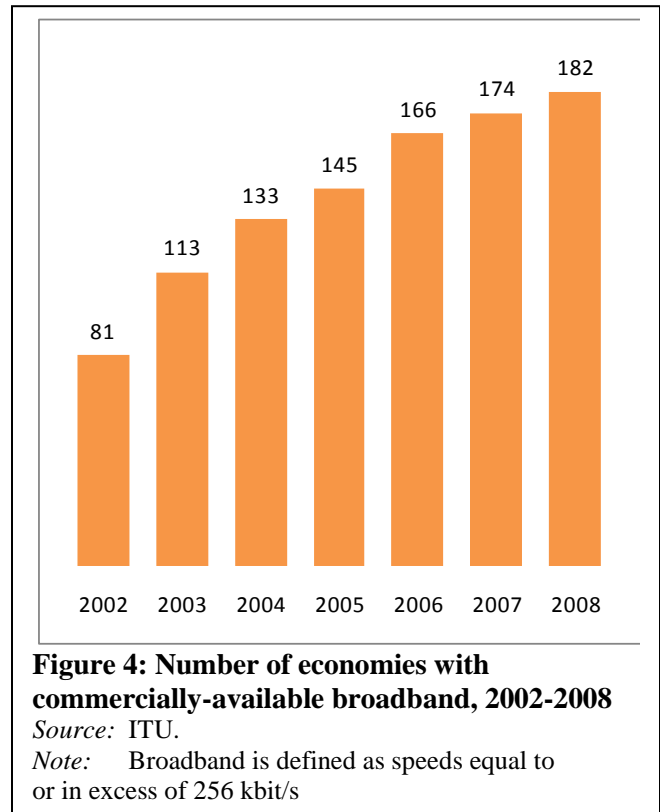
What should be the role of government in the provision of broadband? The Annex to this note provides a summary of the economic characteristics of ICT markets and the basis for policy interventions in the sector. The basic principle is that they should only intervene based on sound economic principles and where the benefits of such intervention outweigh the costs. There are essentially two different roles for the public sector – making markets work more efficiently and ensuring equitable access for all.

Making markets work more efficiently

Already by 2008, broadband service was available in 182 economies (see Figure 4) and, by the start of 2009, the combined total of global broadband users on fixed and mobile networks exceeded one billion. Since the vast majority of these broadband connections have been supplied by privately-operated companies, it might be thought that the market is working quite effectively and that there are no market failures in the broadband market.

However, there are market failures in broadband, as in many other markets for the provision of public infrastructure. The structure of the broadband market itself has sometimes created problems for the development of the service. The most common form of market failure is the persistence of monopoly-type structures in the provision of broadband infrastructure, even when no legal monopoly exists. In many countries, the dominance of incumbent public telecommunications operators arising from their historical monopoly position has been one of the key obstacles to the development of effective competition in the broadband market. But other market failures may be associated with lack of economies of scale. Difficulties in obtaining legal permission to operate, inefficient allocation of radio-spectrum, poor information and limited capital markets are all further examples of these market failures.

These market failures in the ICT sector have been widely recognized by governments around the world. They are typically addressed through regulatory policy: liberalizing licensing regimes, facilitating efficient access to radio-spectrum and regulating access to dominant operators' networks have all been cornerstones of the policies that have provided the foundation for the rapid expansion of broadband services in many countries of the world. In Europe and some developing countries, the key broadband policies have focused on providing regulated access to the incumbent operator's network ("unbundling the local loop"). Other economies have focused on providing low-cost access to existing infrastructure facilities such as energy and transport networks.



In France, for instance, a “ladder of investment” approach can be seen in the evolution of the broadband market. This term was coined by Martin Cave¹² and adopted by the European Regulatory Group¹³. At the lowest level is resale of the incumbent’s capacity, which requires interconnection at only one point in a network. Later, bitstream access was offered at a regional level, whereby the entrant would interconnect at multiple regional points and construct a backbone network between them. As full unbundling of the local loop was mandated, full-service operators, such as Iliad (free.fr), have further generated growth in direct competition to the incumbent, France Télécom (See Figure 5), while building their own networks.

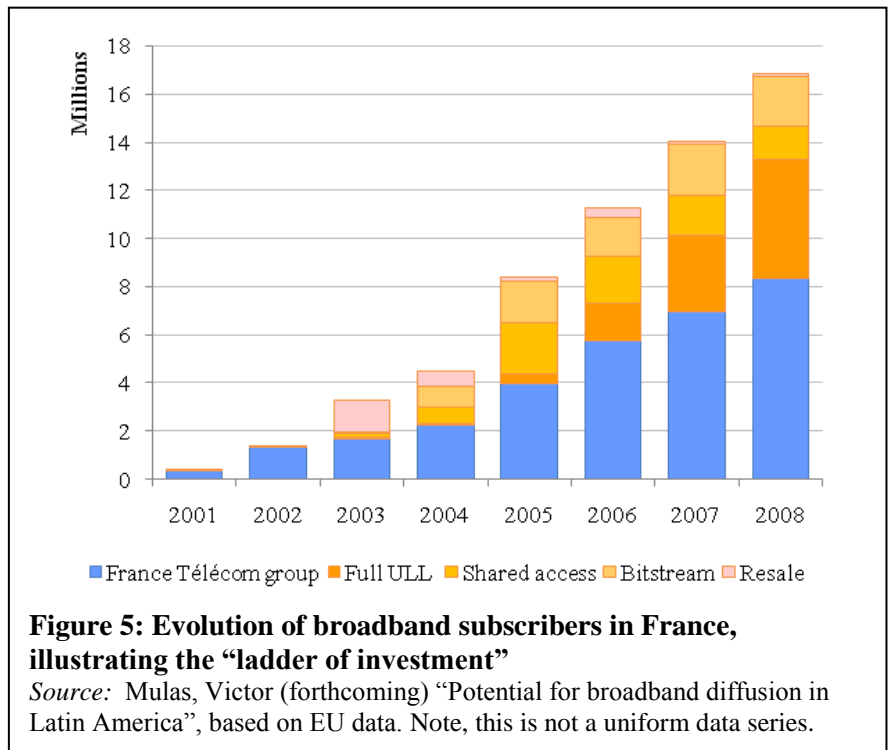


Figure 5: Evolution of broadband subscribers in France, illustrating the “ladder of investment”

Source: Mulas, Victor (forthcoming) “Potential for broadband diffusion in Latin America”, based on EU data. Note, this is not a uniform data series.

Some countries, such as the Republic of Korea, have gone further than this market regulation approach by providing positive financial incentives for operators to invest and compete. In the early days of broadband development, this allowed Korea to “defy the S-curve” and to expand the market at a faster rate than might otherwise be expected (see Figure 6). The government of Korea has intervened consistently in both the supply- and the demand-side of broadband diffusion with more than six major programmes since 1985. Initially, the government funded a backbone national network that connected public institutions throughout the country and provided incentives to operators to expand fiber optic networks. It also developed an extensive e-government programme that digitized and connected public institutions. Finally, the

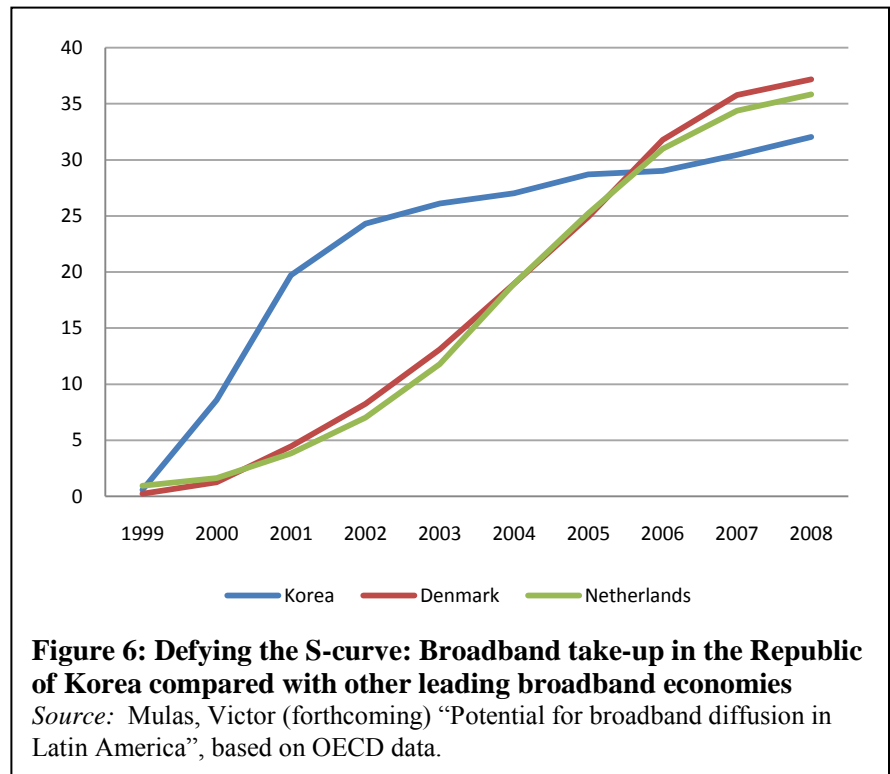


Figure 6: Defying the S-curve: Broadband take-up in the Republic of Korea compared with other leading broadband economies

Source: Mulas, Victor (forthcoming) “Potential for broadband diffusion in Latin America”, based on OECD data.

¹² Cave, Martin (2004) *Making the ladder of investment operational*.

¹³ European Regulatory Group. (2005). *Broadband Market Competition Report*.

government also provided funds to foster demand through multiple policies, such as ICT training and promotion of local applications.

Although other economies, such as Denmark and the Netherlands, have subsequently overtaken Korea in broadband penetration as measured by per-inhabitant penetration, Korea still leads in terms of household penetration, with 94 per cent coverage by the end of 1998. The initial lead it was able to establish has helped Korea to realize economic and social benefits. For instance, since the late 1990s, Korea has seen the percentage of its national GDP coming from the ICT services sector double. Korea has also emerged as one of the leading economies in terms of improved educational attainment in the OECD’s PISA (Programme for International Student Assessment) survey¹⁴.

The Korea case can be characterized as a “public/private partnership” in which the government has provided “administrative guidance” to the private sector and has worked via public/private institutions to foster national targets and goals. In other countries, it is the regulator that has set the tone by establishing an environment conducive to intensive competition. In the United Kingdom, the structural separation of the incumbent, BT, appears to have had an immediate beneficial effect on broadband uptake (Figure 7). Interestingly, it was BT itself that offered this solution in 2005, following Ofcom’s review of the market, perhaps as a way of heading off a more radical restructuring. The main obligations agreed between BT and Ofcom were that a new and operationally separated division (Openreach) would be created, staffed with BT’s employees, responsible for network operations, which would run at arms-length from BT management. Openreach would then provide services to all players on the basis of “equivalence of inputs” and an independent body – the Equality of Access Board – was created to ensure compliance. Although BT’s direct market share declined after 2005, the overall market boomed.

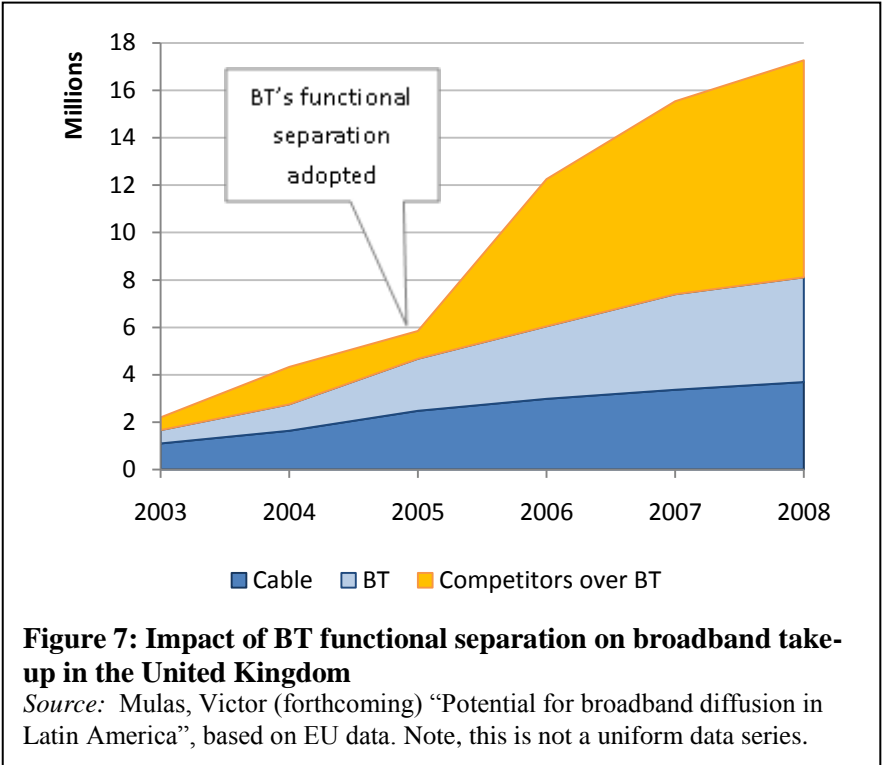


Figure 7: Impact of BT functional separation on broadband take-up in the United Kingdom

Source: Mulas, Victor (forthcoming) “Potential for broadband diffusion in Latin America”, based on EU data. Note, this is not a uniform data series.

Ensuring equitable access for all

In broad terms, the second major role of governments is ensuring equitable access for all. This focus on equity counterbalances the emphasis on efficiency outlined above. Most governments have taken a proactive approach to stimulating network roll-out in rural and other underserved areas. This was traditionally done through internal cross-subsidization by the state-owned monopoly operator.

¹⁴ See OECD Programme for International Student Assessment at www.pisa.oecd.org. PISA is a triennial survey of the knowledge and skills of 15-year olds. The latest assessment presents 2006 results for some 400’000 students in 57 countries worldwide. The Republic of Korea scores above the OECD average and had the highest score in the OECD area for reading, in the top two for mathematics and one of the highest for Science scores. More significant is the improvement in Korea’s performance since 2000, which was the period of expansion in broadband, both in schools and in homes.

Following market liberalization, this approach has been replaced by explicit subsidy mechanisms such as Universal Service Funds.

As an example, Canada is a country that achieved early prominence in broadband (it had the world's highest penetration levels between 1998 and 2000), despite having a very low population density. The problem of providing service in remote and rural Canada was studied by the Independent Telecommunications Review Panel, which reported in 2006. In an annex to their report, they argued that the government should set a goal of providing affordable and reliable broadband services in all regions of the country by 2010. The panel mapped the availability of broadband and estimated that just under 90 per cent of Canadians would have access by 2007, leaving around 3 million people without access, of which for 300'000 or so living in the most remote communities, satellite would be the most practical solution. Areas that were uneconomic to serve were found to be those with fewer than 1'200 people living within a radius of more than 5km from a broadband point of presence, and that this was further affected by terrain. WiMAX might help reduce the number that could not be served economically by 1.2 million, but for the remaining 1.5 million (plus the 300'000 to be served only by satellite); some form of targeted cross-subsidy would be necessary to achieve the goal of universal broadband service by 2010.

One of the most high profile initiatives is a scheme to provide broadband to Canadians in the far North, in Nunavut and Northern Territories. The Nunavut Broadband Development Corporation¹⁵ has been established as a not-for-profit, federally registered corporation with a multi-stakeholder membership, with the aim of bringing broadband to 25 unserved communities. Under a five-year plan signed in January 2009 (as part of the economic stimulus programme), matching funds from Infrastructure Canada and local customers will raise some C\$43.2 million to bring broadband by satellite to the region.

Providing broadband in rural areas poses significant economic and technical challenges. Costs in areas of low population density are higher and, unlike other ICTs, the provision of broadband (for instance, using digital subscriber line (DSL) technologies) has technical constraints by which available speeds diminish with increasing distance from a central location. The rapid growth of the broadband market has therefore focused primarily on urban centers leaving the majority of people in rural areas unable to access network services. As public and private services are increasingly provided online, the inability for some parts of the population to get access to broadband becomes more of a public policy problem. Once broadband usage reaches a critical mass, (e.g., 25 per cent) it will come to be considered indispensable for all if balanced development is to be achieved without discrimination based on geographical location. This has led governments to consider a more active approach to ensuring broadband is available throughout their territories. In Korea, the government adopted a comprehensive broadband strategy which focused on providing financial incentives to operators to invest in their networks¹⁶. In Europe, countries such as Sweden¹⁷ and France¹⁸ have used a mix of demand aggregation, public-private-partnerships and USO approaches to ensure that broadband is available throughout their territories. In Norway, the government has a programme to subsidize the roll out of broadband infrastructures in areas with no existing infrastructure in place. The goal of the government is to connect 99 percent of the population through fixed broadband coverage.¹⁹

¹⁵ See: <http://www.nunavut-broadband.ca/>.

¹⁶ See, for example, ITU (2003) *Broadband Korea: Internet Case Study*.

¹⁷ Explaining International Broadband Leadership, Robert D. Atkinson, Daniel K. Correa, Julie A. Hedlund, The Information Technology and Innovation Foundation, May 2008

¹⁸ Broadband for Africa, Policy for Promoting the Development of Backbone Networks, World Bank 2008

¹⁹ See OECD (2008) *Broadband Growth and Policies in OECD Countries*. Paris: OECD

Most recently, broadband investment has featured in fiscal stimulus plans around the world. Australia has committed around US\$33 bn while the US administration has set aside US\$7.2 bn for rural broadband²⁰ (See Figure 8). Broadband is seen as providing a quick win in these stimulus plans because, on the supply side, it stimulates investment and employment while, on the demand side, it creates opportunities for entrepreneurship and spillover effects that benefit the general economy.

The role of donors, including the World Bank

The World Bank can support governments in developing their broadband services. By information-sharing, benchmarking, technical

assistance and support in regulation, the World Bank can help governments to improve the functioning of markets, stimulate investment and learn from the experiences of other countries.

The World Bank can also provide financing for strategic investments to support the development of key parts of the infrastructure. International submarine cables, cross-border connectivity and high-capacity domestic backbone networks are all examples of areas in which World Bank investments can play a catalytic role, crowding-in private sector investment and improving service delivery. The EASSy cable along the East coast of Africa and the RCIP program throughout Eastern and Southern Africa are all examples of where the World Bank is supporting the development of these key infrastructure bottlenecks through Public-Private-Partnerships.

Broadband is an areas of growth in the project portfolio of both the public and private sector investment projects. More than US\$1 bn is currently committed in ICT investment projects and this has been a catalyst in raising some US\$7 bn in investment capital. The World Bank is currently engaging in a major exercise to gather together international experience of broadband policies and developing a broadband toolkit which will be available to governments and regulators around the world.

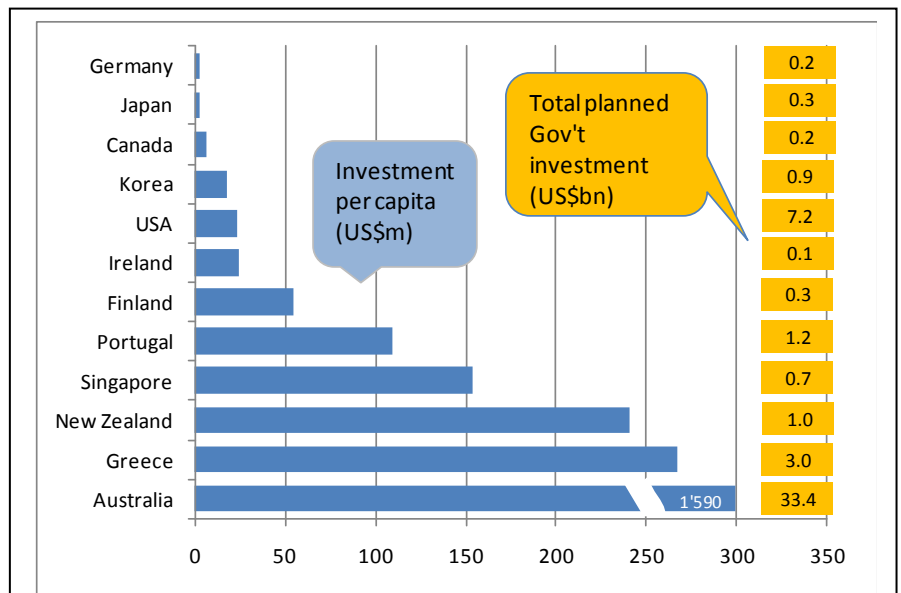


Figure 8: Government planned spending on broadband as a component of economic stimulus packages

Source: World Bank, based on data from ITU, Booz and Co and OECD.

²⁰ See analysis presented in Qiang, Christine (2009) [Broadband Infrastructure Investment in Stimulus Packages: Relevance for developing countries.](#)

Annex 1: Efficiency and Equity in the ICT Sector

| | Reasons | Characteristics | Examples in the ICT Sector | Implications for sector policy |
|-------------------|---------------|---|--|--|
| Efficiency | Externalities | <ul style="list-style-type: none"> ▪ Spillover effect: Marginal social/economy-wide benefit will exceed marginal private/individual/single-sector benefit ▪ Network effect: The overall value of a network increases as the number of consumers goes up | <ul style="list-style-type: none"> ▪ ICT is a General Purpose Technology that facilitates great leaps of innovation, results in a fundamental restructuring of the economy and has a positive impact on productivity, trade/exports and economic growth. ▪ Investments in broadband infrastructure may increase the payoffs from investments in sectors such as education/health/agriculture etc. ▪ Efficient and accountable e-government services facilitate good governance and improves business/investment climate. ▪ IT industry: IT is proven to have spillover effects and contribute to the economy through productivity gains, innovation, etc. in IT-using sectors of both manufacturing and services. ▪ Telecom infrastructure (both voice and Internet services) has network effects. The new world of <i>wikinomics</i> is stimulating an emerging paradigm of value co-creation. | <ul style="list-style-type: none"> ▪ Government has an interest in ensuring that affordable ICT infrastructure is widely available so that its services can be delivered over it. ▪ Public investment (in partnership with the private sector) in e-government services. ▪ Policies aimed at plural media leading to responsive and accountable government. ▪ Public support targeted for the IT industry, where appropriate. ▪ Support for awareness-raising of ICT use and for ICT skills development in other sectors. |
| | Public goods | <ul style="list-style-type: none"> ▪ Excludability: the impossibility or very high cost of excluding people who do not pay ▪ Non-rivalry in consumption (i.e. one person's consumption of the good/service does not diminish the ability of other's to consume it) | Content (information/knowledge) has attributes of public goods: The fixed cost of producing and retaining ownership can be very high. But it is commodious and ubiquitous with very low marginal distribution costs, making it difficult to exclude people. | <ul style="list-style-type: none"> ▪ Law, regulation and policies on IPR, public access to information, etc. ▪ Support for the creation and consolidation of content. |

| | Reasons | Characteristics | Examples in the ICT Sector | Implications for sector policy |
|---------------|---------------------------------|---|--|---|
| | Imperfect competition | <ul style="list-style-type: none"> ▪ High up-front investment costs required for market entry and sunk nature of these costs may constrain the development of competition and increase investment costs. ▪ Competitive markets also depend on the absence of monopolistic market structures and behavior. | <ul style="list-style-type: none"> ▪ Anti-competitive behavior, e.g. telecom monopolies, discriminative interconnection ▪ Large economies of scale and high start-up costs of backbone networks, like all other infrastructure ▪ New technologies and convergence pose new challenges to competition policies (regulation, policies) | <ul style="list-style-type: none"> ▪ Market liberalization and regulations to promote effective competition. ▪ Infrastructure sharing and open access policies ▪ Reduce commercial risk associated with high fixed cost investment through risk guarantees, demand aggregation strategies. ▪ Initiatives to catalyze investment in key telecom infrastructure (EASSy/RCIP). |
| | Imperfect information | <ul style="list-style-type: none"> ▪ Competitive markets depend on consumers being able to make informed choices, and suppliers knowing the actual and potential demand. | <ul style="list-style-type: none"> ▪ There is imperfect information about advanced ICT services and their returns. ▪ ICT can help markets work better, reduce the exploitation of middle-men, and extend market economies to households living in subsistence economies and small businesses to participate in (national and international) trade. | <ul style="list-style-type: none"> ▪ Support for awareness raising and ICT training/education. ▪ Support for demand aggregation. ▪ Support for interventions to address information asymmetry using ICT. |
| Equity | Income equity | <ul style="list-style-type: none"> ▪ Everyone should have access to public services and income opportunities which allow them to fully participate in the life of the society. | <ul style="list-style-type: none"> ▪ Uneven access to ICT services in rural areas and of the disadvantaged will exacerbate existing income inequalities, i.e. the digital divide. ▪ Lack of access to communications services creates barriers for family/social contact, excludes people from ICT-based communities and limits access to political participation. ▪ Lack of access to communications services can limit access to public services or affect quality (e.g. e-government services, ICT-based health-care services, agricultural extension programs, voting). | <ul style="list-style-type: none"> ▪ Public support to provide services in (remote) areas where the market will not sustain effective competition (e.g. through incentives, regulatory interventions, access to public infrastructure, free services, etc.) ▪ Regulations to provide ICT access to the disabled (e.g. access regulations for the fixed service for the hearing-impaired). |
| | Social inclusion | | | |
| | Equal access to public services | | | |

Note: EASSy = Eastern Africa Submarine Cable System. RCIP = Regional Communications Infrastructure Programme.